

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re New DIVISIONAL Patent Application of:)
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Shigeru SAKUMA et al.)
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Application No.: Not yet Assigned)
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Filed: October 22, 2001)
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Prior Application No.: 09/257,296)
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Prior Application Filed: February 25, 1999)
)
For: MANUFACTURING METHOD FOR)
CALCIUM FLUORIDE AND CALCIUM)
FLOURIDE FOR PHOTOLITHOGRAPHY)

Group Art Unit: 1765

Examiner: B. Tran

Commissioner for Patents
Washington D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-identified application on the merits, please amend the application as follows:

Please cancel claims 17-19 and 40-42.

Please amend claims 1, 9, 20, 21, 22, 26, and 33, to read as follows:

(Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved through an annealing process comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

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heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

the first temperature is between 1020 °C to 1150 °C.

9. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said first container and the temperature inside said second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C.

20. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

a balance between an effect of improving the optical properties of said single crystal of calcium fluoride and the productivity, including delivery time and cost, is achieved, such that, during a high temperature range, the temperature is lowered at a slow rate, and during a low temperature range that is lower than the high temperature range, the temperature is lowered faster as the temperature becomes lower.

A³
"FOOTNOTES"
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said container is filled with an inert gas, and the inside of said container is maintained at an atmosphere of approximately 1 atm such that said single crystal of calcium fluoride is not oxidized.

heating said first container with a heater arranged external to said first container such that the temperature inside said second container is raised to a first temperature, which is lower than a

melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

A³ maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said second container to room temperature, and

opening the inside of said first container to a normal atmosphere,

wherein,

at a minimum, in order to prevent oxidation of said single crystal of calcium fluoride during the process, the process is carried out such that said fluorination agent is vaporized and becomes a fluorine gas atmosphere inside of said second container, while a pressure inside said first container is maintained at approximately 1 atm.

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A⁴ 26. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at the first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,
wherein,
the first temperature, which is between 1020 °C and 1150 °C, is lowered to a second
temperature, which is in the range of around 600 °C to 900 °C, at a rate of 1.2 °C/hour or less.

33. (Amended) A manufacturing method for a single crystal of calcium fluoride having its
optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second
container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that
a temperature inside said second container is raised to a first temperature, which is lower than a
melting point of said single crystal of calcium fluoride, while said second container is filled with
a fluorine gas atmosphere,

maintaining the temperature inside said second container at said first temperature for a
designated period of time,

lowering the temperature inside second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C, and

the temperature is decreased from said first temperature to a second temperature, which is
in the range of around 600 to 900 °C, at a rate of 1.2 °C/hour or less.

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